ing conditions at Ramleh over the same period differs from the previous one in that the ordinates represent the hours of the day. Here, also winds of equal intensity are joined by curves. Winds of over 6 meters per second are sufficient to carry with them clouds of dust and these dust storms are shown by hachure.—*C. L. M.*

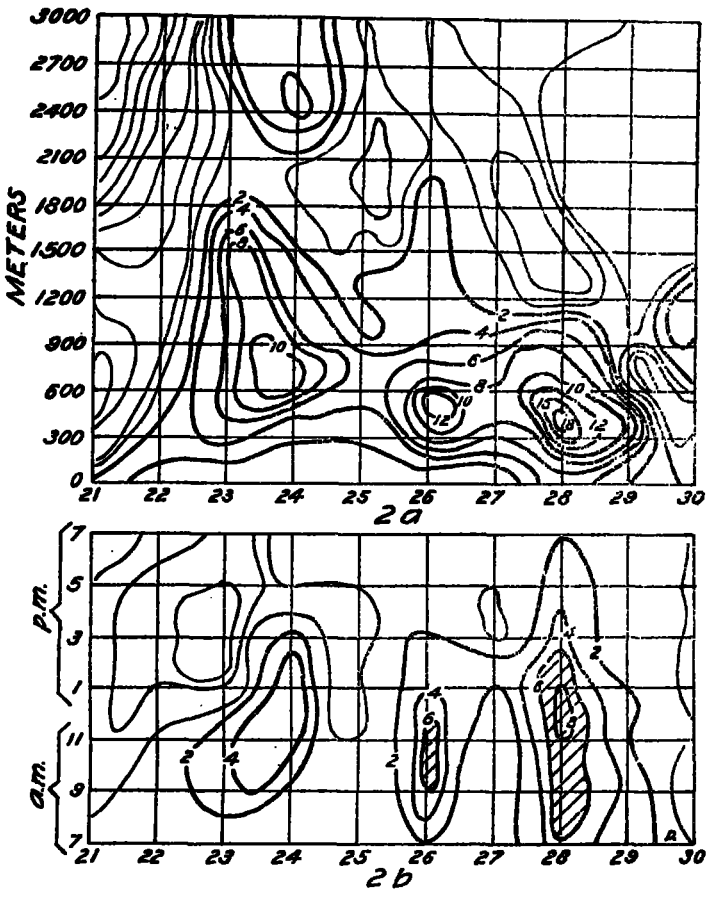

FIG. 2a.—Lines of equal wind strength above Ramleh, March 21-30, 1917; heavy lines being sirocco wind, light lines, sea wind.
FIG. 2b.—Lines of equal surface wind strength at Ramleh, March 21-30, 1917; heavy lines being sirocco wind, light lines, sea wind.

THE COOL BREEZE OF THE SHADOW OF THE CUMULUS.[1]

By W. J. HUMPHREYS.

[Weather Bureau, Washington, D. C., Apr. 21, 1921.]

In respect to many things it may be sanely philosophical to "take the good the gods provide thee" and ask no questions, but in meteorology, at least, such *sans souci* is unscientific, however great our gratitude. And so it happens that when, on a sweltering day, the passing cumulus, for instance, brings its grateful breeze we ask whence it came and how. Well, the answer is not entirely simple, not all in just a word or two, but still clear enough to give something of that mental satisfaction that comes with every conscious understanding. Essentially it is as follows:

During calm, clear summer days, the surface of the earth, especially in more or less arid regions, becomes strongly heated by the sunshine. This heated surface in turn correspondingly warms the adjacent air and thereby establishes a proportionately vigorous vertical convection in the lower atmosphere. Convection, however, can not extend through the heated surface, hence the very lowest air is rather stagnant and superheated. Indeed, while the amount of convectional mixing rapidly increases with elevation, nevertheless it often is still imperfect at a level of even several hundred feet. Throughout all that region, however, in which convection is perfect a slightly warmed mass of air would continue to rise, and a cooled mass continue to fall, being at each level a little warmer or a little cooler, respectively, than the then adjacent atmosphere of the same level.

Now, obviously, free air (air at an appreciable altitude above the surface) in the sunshine usually is a trifle warmer than is the neighboring air at the same level within the shade of a cumulus. Hence, in general, the former is ascending and the latter descending, except just under the forward base of the cloud—a mere detail that need not here be further considered. Clearly, too, the descending air must spread out near the surface—spread out because it can not blow into the ground—and it is this spreading out of the descending air that constitutes the gentle breeze that so frequently accompanies the shadow of the cumulus cloud.

The refreshing drop in temperature that also accompanies the shadow of the cumulus is yet to be explained.

Since the air is heated mainly by the surface of the earth which itself was warmed by the absorption of solar radiation, and since the very lowest air is not vigorously mixed by convection, it follows that during a calm summer day, sand and barren soil, the adjacent air, and even one's outer clothing, all become quite hot when exposed to the sunshine—often 10 degrees or more hotter than the free air 50 to 100 feet above. Within a few minutes, however, after a heavy shadow comes on nearly all this excess of temperature has disappeared—lost by radiation, convection, and conduction. Hence the breeze due to the descending air within the cumulus shadow, explained above, is really cool, in comparison to the superheated surface air out in the sunshine; it is, in truth, the well-known and ever-grateful cool breeze of the shadow of the cumulus.

[1] Presented before the American Meteorological Society at Washington, Apr. 21, 1921.

BIBLIOGRAPHIC NOTES ON THE TEMPERATURE CHARTS OF THE UNITED STATES.

551.524 (084.3) (73)

By ROBERT DE C. WARD.

[Harvard University, Cambridge, Mass., June 8, 1921.]

In connection with a general study of the climatology of the United States upon which the writer has for some years been engaged, brief references have from time to time been made on the various available isothermal charts of this country. The publication of the following notes on these charts may be of interest to others for two reasons. First, because of the completion, for the section on climate of the new *Atlas of American Agriculture*, of a wholly new set of temperature maps,[1] and, secondly, because no list of the earlier charts seems heretofore to have been printed. The following bibliography contains reference to all the charts to which the writer has, up to the present time, been able to gain access. There may be, and doubtless are, omissions.[2] It is not the purpose of

[1] Not yet published.
[2] Readers of the REVIEW will confer a favor on the writer by notifying him of any such.